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ABSTRACT

An analysis was conducted of the results of a formative evaluation of the LiteracyLink "Workplace Essential Skills" (WES) learning system conducted in the fall of 1998. (The WES learning system is a multimedia learning system integrating text, sound, graphics, animation, video, and images in a computer system and includes a videotape series, a workbook text, and a Web site. The program addresses basic skills in reading, writing, communication, and mathematics in a workplace context. It also covers issues of job searching, career planning, and workplace orientation. The program is based on adult learning theory.) The analysis was intended to interpret how the formative evaluation's results should be applied in revisions to the design of the WES learning system. Five design issues were discussed and interpreted: (1) redundancy versus reinforcement across media; (2) readability; (3) responses to the videotape, workbook, and online materials as stand-alone products; (4) pedagogical assumptions underlying the writing and media design; and (5) effectiveness of the teacher's guide. Suggestions were made for revisions of the materials in line with adult learning and technological advancements. (Contains 14 references.) (KC)

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Designing multimedia learning systems for adult learners:

Basic skills with a workforce emphasis

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Abstract

This working paper reviews and analyzes results of a formative evaluation of the LiteracyLink *Workplace Essential Skills* (WES) learning system conducted in the fall of 1998. In large, complex technology projects, even formative evaluation results require interpretation and judgment regarding how they should be applied in revisions to the design. This paper provides a glimpse into that part of the research and development process rarely reported in technical reports or journal articles published after a project has been completed. Five design issues are discussed and interpreted: (a) redundancy versus reinforcement across media; (b) readability; (c) responses to the video, workbook, and online materials as stand alone products; (d) pedagogical assumptions underlying the writing and media design; and (e) effectiveness of the teacher's guide. Issues are analyzed in relation to design principles underlying development, and how and whether revisions should be applied to the WES products.

Introduction

In theory, the design of technological learning systems is based on principles and guidelines derived from theory, empirical research, experience, and the constraints or possibilities of the technologies used. Throughout the process, specific design decisions are made based on the designer's best judgment of how to apply principles and guidelines in practice – a task that requires drawing inferences and generalizations. In practice, innovations and assumptions seem to outnumber empirically proven guidelines, especially when a new technology is just emerging or is being introduced to a new audience. Formative evaluation provides the mechanism for testing the quality of those design innovations and assumptions. However, in large, complex technology systems and projects, formative evaluation results require interpretation and judgment regarding how revisions to the product design should be implemented.

The purpose of this working paper is to review lessons learned about the design of the LiteracyLink *Workplace Essential Skills* (WES) learning system, as a result of a formative evaluation conducted by the Institute for Social Research (Johnston & Young, 1999) in the fall of 1998. The paper provides a glimpse into the process of research and development rarely reported in the technical reports or research journal articles that are published after a project has been completed. The issues raised will be of specific interest to members of the adult literacy community – researchers, designers, and practitioners - as well as instructional designers and evaluators who are involved in technology projects.

Background

The LiteracyLink project

The U.S. Department of Education, through its Star Schools grants program, has funded the LiteracyLink project, a joint venture of PBS, Kentucky Educational Television (KET), the National Center on Adult Literacy (NCAL) at the University of Pennsylvania, and the Kentucky Department of Education. The project uses video, online, and Internet computer technology to help adults receive literacy instruction and gain a high school diploma or equivalent.

One component of the LiteracyLink project is the Workplace Essential Skills (WES) multimedia learning system. Multimedia refers to the integration of media such as text, sound, graphics, animation, video, and images in a computer system (Jonassen & Reeves, 1996). The WES multimedia system includes video, workbook/text, and a website. The video series consists of 26 programs addressing basic skills in reading, writing,

communication, and mathematics in a workplace context. The series also addresses issues of job searching, career planning, and workplace orientation. Four printed workbooks serve as companion pieces. The online portion is designed to deliver instructional content integrating clips from the video and other Internet resources in easy-to-use electronic formats. The learning activities are designed to encourage interactive access to a wide range of relevant materials both in the LiteracyLink website and on the Internet at large. The WES system was launched nationally in September 1999.

Applying adult learning theory to the design of technological learning systems

Stites (1998) reviewed the literature on adult learning and development, and derived four general principles relevant to learning and instruction with technology. He recommends that designers (a) plan for learning across the lifespan, (b) identify distinctive characteristics of adult learners, (c) emphasize the goals of adults, and (d) create adult-situated contexts for learning. Stites draws on such notable theorists as Freire (1970), Houle (1984), Knowles (1990), and Mezirow (1995), as well as cognitive learning theories (e.g., Collins, Brown, & Newman, 1989) to support his synthesis.

In considering how to translate these principles into an instructional design delivered via a multimedia system (in this case, the media consisting of print, video, and web-based learning materials), foremost must be considerations of the strengths each medium affords. Video is effective for setting context, modeling, motivating, and illustrating concepts and examples. Texts and workbooks are the traditional workhorses of print pedagogy. They organize and sequence content and present information, explanations, examples, questions, activities, and assessments in a durable, portable form. Strengths of computer media include the capabilities of data processing, storage, and retrieval, as well as generative applications such as word processing, graphic design, spreadsheets, databases, and other programming. Computers can store and display print, graphics, photos, animation, and video. Networked computers provide the added capabilities of communication and access to wider informational resources. Internet-connected computers provide access to vast amounts of information and resources that are otherwise unattainable in a single instructional setting.

In summary, multimedia products provide a variety of mechanisms for creating practical, flexible implementation of adult learning principles to support multiple learning environments. The role of the designer is to select and apply a set of features afforded by each medium into a design that facilitates effective learning.

Design features in the WES system

The LiteracyLink/WES system is a hybrid of classroom-based activities and individual tutorial instruction. The WES videos use a combination of documentary footage of real workplaces including interviews with workers, supervisors, and experts that create authentic settings, models, and motivation for conceptual content. Dramatized scenarios were also used to show problem situations and model how adults might go about solving them by applying knowledge and skills. Teachers were provided with lesson plans that engage groups of learners in *Before*, *During*, and *After* discussions and activities related to the video programs.

Print publications for the series apply a traditional instructional workbook text design by presenting basic concepts and vocabularies, describing authentic workplace case scenarios, and providing open-ended and closed-end activities to help learners practice applying skills. Each workbook chapter began with an introduction and overview of the corresponding video program, as well as statements of unit objectives and discussion questions. Pre- and post-tests in the workbook helped learners self-assess their understanding and progress in learning basic concepts.

At the time of the formative evaluation, the online system was primarily an individual tutorial instruction system. Learners worked one at a time on online activities and saved their results to a personal electronic file. At the time, there were no tools for learners to share and communicate with others online. In the absence of online communication tools, group-oriented social interactive activities were based on suggested activities in the online instruction and teacher's guide that facilitated social learning and communication. The opportunity to visit websites external to the LiteracyLink site, and to potentially communicate with others through those sites, was a feature of the online design that introduced learners to the wider world of resources available on the Internet, as well as created an awareness of the different navigational and organizational structures and communication possibilities of websites.

In sum, the LiteracyLink/WES learning environment was designed to use multiple media to maximize opportunities for learner-centered, social, contextualized, and problem-focused learning. Before attempting to validate that applying these principles in WES would lead to instructional gains (i.e., summative evaluation), even more basic issues of usability, appeal, and comprehensibility of design needed to be addressed (Flagg, 1990). For this reason, a formative evaluation study piloting a subset of the WES products was conducted.

Purpose of formative evaluation and research questions

The LiteracyLink Star Schools project was funded to produce a variety of multimedia materials (video, print, and Internet-based) directed at adult literacy learners and teachers. While video and print media are familiar classroom curriculum materials for this audience, computers and the Internet are still novel classroom tools for most. In adult education, computers are more often used for individual tutorials, rather than integrated into the day-to-day classroom environment (Ginsburg, 1998). There is little adult literacy research on how computers are to be integrated in classroom-wide instruction, though there are ample examples and guides from the K-12 literature.

The broad research questions guiding the formative evaluation of LiteracyLink/WES (Johnston & Young, 1999) were as follows:

- Video - Is the video interesting and comprehensible? Does it stimulate discussion? Do reactions to the videos remain constant for the duration of the course?
- Workbook - Is the workbook interesting and comprehensible? Are the tasks/exercises easily understood? Are the tasks valued? Do reactions to the videos remain constant for the duration of the course?
- Online Materials - Can learners access and navigate the online materials easily? Are the tasks easily understood and completed? Do learners value the online activities? Do reactions to the videos remain constant for the duration of the course?

Emerging from these broad questions were more specific issues of the appeal, usability, and comprehensibility of the design and content. After describing the design and methods used to conduct the formative evaluation, we will return to a discussion of the specific issues that emerged.

Methods

Curriculum and materials piloted

The pilot consisted of two 4-6 week, mini-courses based on available products in fall of 1998. These courses were *Finding a Job* (Units 1-5) and *Workplace Writing* (Units 13-15). Each unit consisted of one half-hour video, one workbook chapter, and one set of online activities (typically 2 to 3 individual lesson activities). Teachers attempted to cover one unit a week in the *Finding a Job* mini-course, and about one unit every week and a half for *Workplace Writing*. In addition, each teacher received one day of training by LiteracyLink staff as well as a teacher's guide. The teacher's guide consisted of an overview of the project, introductory sections describing the navigation and structure of the Internet site, as well as brief *Before*, *During*, and *After* lesson plan activity selections for each video, workbook chapter subsection, and online video activity.

Data source

LiteracyLink is working with 25 innovation sites clustered in the vicinity of Los Angeles, CA; Buffalo, NY; Des Moines, IA; Lexington, KY; Philadelphia, PA; and Reno, NV. The innovation sites consist of local adult literacy programs sponsored by community-based organizations, community colleges, or private or public schools. The pilot test sample consisted of 14 classrooms (7 each teaching *Finding a Job* and *Workplace Writing*) and 19 teachers (3 classes were team-taught) who volunteered and met selection criteria for this evaluation. The criteria consisted of being able to recruit 5-15 learners, pilot materials for 4-6 weeks, attend a one-day training session, and provide weekly feedback. Some teachers had been participating in the LiteracyLink project for some time and were familiar with goals, approaches, and existing products; others were introduced to the project as part of this formative pilot.

The total number of learners as of week one of the mini-courses was 90, with 66 remaining at the end, for an attrition rate of 27%. This attrition rate is consistent with other estimates of adult literacy programs. The learner sample was 47% male, with 48% between 16-18 years of age, 26% between 19-35, and 24% 36 and older. The highest grade level was between 9-11 for 63%, with 8% less than 9, and 29% 12th grade or more based on placement testing or teacher estimations.

Data collection and implementation procedures

Data was collected from both teachers and learners. Data collection from learners consisted of a baseline questionnaire; weekly diary of time spent, readability of materials and clarity of tasks, and perceived learning; and an end-of-course survey including perceived learning and course rating. Data collection from teachers consisted of weekly e-mail questionnaires of teaching/learning issues and reflections on the teacher's guide, and an end-of-course survey on teaching/learning issues and recommendations for adoption. Classroom observations were also conducted. All student online activities were collected and saved as part of individual student records.

Classroom teachers selected for the pilot received a one-day training by LiteracyLink staff. The training was designed to be hands-on demonstrations of effective, integrated classroom uses of the video, workbook, and online system. Teachers also received a visit from LiteracyLink technical staff to help configure classroom technologies. Teachers had access to a technical support hotline at PBS for answering both technology and instructional questions.

Results

Johnston and Young (1999) raised a number of issues that might need to be addressed or adjusted to increase the usefulness of the WES products. These are the following:

- redundancy versus reinforcement across the three media
- readability of the products
- responses to the video, workbook, and online materials as stand alone products
- pedagogical assumptions underlying the writing and media design
- effectiveness of the teacher's guide

In the following sections, the design principle applied to the products is presented, followed by summary of the general results reported by Johnston and Young, and then a discussion of implications and interpretations of the design team.

Redundancy versus reinforcement across the three media

There was a high level of redundancy built into the WES design as a means of building familiarity, as a reinforcement of content, and to maximize the potential for each media to be used as a stand alone product. One reason for the high level of redundancy was to allow for more flexible mix and match uses of the different media products. We anticipated that the LiteracyLink/WES materials might be configured differently based on the availability or portability of media, the nature of the program or classroom organization, and/or individual differences in learner needs or preferences. For example, regarding access to media and program organization, learners may view videos at home, do workbook activities as homework, and work online in class. Alternatively, learners may watch and discuss the video in class, work in small groups on workbook activities, then do online activities in a library or tech lab.

Regarding individual differences, learners who have a stronger need for in-depth work on a topic such as interviewing may benefit from attempting multiple online and workbook activities, each of which introduces the same concepts, but requires different practice and performance tasks to reinforce and expand the depth of understanding. On the other hand, many learners may master the level of conceptual materials and "essential skills" after working through just one form of the materials.

Johnston and Young (1999) reported that teachers felt that materials were repetitive past the point of simply reinforcing and that there was too much material to cover in each unit. The pilot teachers were asked and trained to present the curriculum in a highly

structured, mostly linear plan based on completing each unit in sequence by viewing the video, then mixing workbook and online activities. The high level of redundancy was most apparent when the curriculum was implemented in this linear, comprehensive classroom course approach. Although our preparation of teachers encouraged flexible configurations, we left teachers with little time to familiarize and plan for a more flexible approach, and no doubt left the impression that coverage of all the materials was important or necessary for effective learning and for evaluation purposes.

Two sources of the redundancy problem were addressed in a subsequent redesign of the online site. First, each instructional unit online began with a lesson plan page that described and linked not only to the online learning activities, but also to anchor, video, and workbook review activities. These three additional "activities" were informational supports for using the video and workbooks – activities that the teacher may have introduced and conducted before the learner went online. These were stripped in later versions, simplifying the look and feel of the online material, as well as reducing the redundant information.

The second source of redundancy was the result of navigational and graphic design. The headers at the top of each page did not clearly present information to help the learners orient themselves and locate what part of the curriculum (unit or activity) they were doing. Every webpage looked almost exactly the same. In addition, there were graphic text boxes at the top of each page that reviewed the correspondence between video program, workbook pages, and online objectives. The graphic boxes themselves were large, taking up most of the screen size, especially on the small monitors that many of the learners were using. All subsequent designs provided much cleaner and clearer navigational and location markers.

Changes to the product also included more targeted teacher support in the forms of professional development, implementation guides, assessment and management tools, and technical support to foster teacher decision making about how best to implement LiteracyLink/WES to support specific instructional goals. Assessments to help a teacher and learner judge mastery of specific concepts and objectives are also under development to help facilitate selective use of materials rather than constraining them to use a comprehensive, linear progression through the materials.

Readability of the products

All designers of educational materials for adults are concerned about the difficulty, challenge, and complexity level of materials and texts. One metric of difficulty is

readability. Traditional readability formulas are based on word, sentence, and paragraph length. Such formulas are correlated with text difficulty because more difficult texts tend to have longer words, sentences, and paragraphs. However, readability formulas are not totally reliable estimations of text difficulty. Furthermore, attempts to simplify a complex text by shortening words and sentences, tends to create less coherent texts, impeding rather than improving comprehensibility (Beck & McKeown, 1986).

The authors of the various LiteracyLink products made an effort to use simple, concise language and to provide glossary and other supports whenever complex terms or concepts were introduced. Readability formulas applied to workbook and online text generally rated materials as between 6th and 8th grade reading levels.

Johnston and Young (1999) reported that teachers and learners found that workbook and online materials required reading skills above the targeted 5th-8th grade level. Learners self-reported experiencing difficulty reading text at an average rate of 23% for the workbooks, 24% for online video activities (that is activities based on the video program), and 31% for Internet activities (that is, activities based on an Internet site external to LiteracyLink, in which reading level could not be controlled). Johnston and Young recommend an extra step in the design process whereby text is critiqued by reading experts.

The recommendation of Johnston and Young (1999) is sensible as is the need to re-examine the level of materials. In defense of the authors of adult educational materials, writing readable texts for adults is challenging. Whereas texts for young children are populated by bunnies, wagons, and other familiar objects and events easily described in plain language, adults, regardless of their personal reading levels, live in a world that uses complex and specific terms and concepts in the spheres of work and community. Only so much simplification can be achieved when the goal is to introduce authentic and relevant adult world information. We take encouragement that 69 to 76% of learners judged the materials just right. We have no way to assess what percentage of this group may have found the materials too easy, nor the impact of decreasing difficulty on their interest and motivation.

Johnston and Young's (1999) observations made us reflect more about the issue of difficulty and challenge level in adult learning in general, beyond the notion of text readability. First, embedded in text difficulty is the issue of complexity of the writing versus complexity of concepts introduced. In general, of the four online sites rated most difficult by learners, three had a Flesch readability index of 5.1 and one had an index of 6.4. This more difficult activity to read (6.4) was about "Paperwork" and had as one of its objectives to "practice getting the information you need to fill out difficult forms" and

introduced the terms and concepts of *document, memo, form, reservation form, billing record, inventory,* and *itinerary.*

In this case, any design change may trade-off perceived text difficulty and real world authenticity, since the real world texts and tasks in this skill area have equal or greater complexity and difficulty that the instructional activity presented. We still hold to the principle that introducing learners to external websites is of the highest priority and value to their learning because it orients them to authentic texts and tasks, even though we acknowledge that we cannot as easily control the readability and difficulty level of such external sites.

Interestingly, this activity was rated as Difficult by 23% as compared to 41% who rated as Difficult another activity in the same unit entitled "Writing a First Draft," which has a 5.1 index. This seems to be evidence that the difficulty being judged by learners is as much about task as it is text.

Johnston and Young's report also led us to reflect on the mixed profiles of individual readers and the mixed reading abilities that teachers often find within a single classroom. Johnston and Young (1999) used teachers' judgments of learners' reading levels because external assessments were not available. No doubt for most classroom decision making the seasoned judgment of an experienced teacher is a valid guide to choosing curricular and instructional materials within their group of students. However, there is reason to doubt that teachers are able to provide normative judgments of their learners' reading levels for cross-class comparisons such as this. This is evident in the table reproduced below by the fact that the students that teachers judged to be at a 7th to 8th grade reading level found texts more difficult than the students teachers judged to be at 5th or 6th grade. Either the 7th-8th grade readers perceived texts as more difficult than the 5th-6th grade readers or the teachers' normative judgements of reading ability were not highly reliable across these two groups.

Percentage of Students Experiencing Difficulty Reading the Text by Teacher Judgment of Students Reading Level (Johnston & Young, 1999)

	Teacher Judgment of Student Reading Level				
	< 5th Grade	5th-6th	7th-8th	>8th	Total
Workbook	40%	25%	36%	15%	23%
Online Video	32%	26%	27%	20%	24%
Internet	38%	27%	35%	30%	31%

Regarding mixed ability levels, consider the Johnston and Young (1999) description of the how teachers assisted some learners. They report:

> At other times, teachers sat with students helping them track print and sound out words. Tracking print involves using a finger or writing implement to point to individual words as a means of maintaining place in text and as a means of helping novice readers parse words into syllables to be sounded out. (p. 38)

We note that readers at a 5th grade level or above should be able to decode words fluently without assistance of the kind indicated. Fifth-grade readers may have difficulty with vocabulary, but should not have difficulty decoding. Johnston and Young (1999) describe a variety of scaffolding techniques used by teachers including pre-teaching vocabulary and concepts and having more fluent students or themselves reading chapters aloud.

This evidence suggests the following possibilities. In some cases, adults with low reading abilities, in this instance less than 5th grade, are placed in higher level classes than their reading levels. More generally, we note that estimates of 25 to 40% reading disabilities in adults in literacy programs have been reported (Giovengo, Moore, & Young, 1998). Learners with reading disabilities will struggle with texts regardless of their absolute reading levels.

Another issue that we have begun to reflect upon is what is the appropriate challenge level for learners and how teachers make those judgments. In many program settings, adults spend relatively little educational time per week in class and therefore have less time overall to engage in challenging, extended, in-depth learning activities. Teachers may also need to be conservative in their use of challenging materials to protect, then build learners' self-esteem and maintain motivation, especially in mixed ability level classes. Sustaining motivation in challenging materials and tasks requires more complex classroom management, motivational techniques, and time. We also do not know the difficulty level of the materials that they may be accustomed to using with adult learners in their classrooms. These factors may have led to a reference point for comparison different than the designers of this product were anticipating. These are issues of the culture of adult basic education and cannot be resolved solely in the design of curriculum materials. More research is needed to understand this issue.

One final methodological issue we note in retrospect. Learners were only asked to judge "some difficulty" versus "just about right." In the future, we may wish to ask whether materials were "easy," "challenging," or "frustrating." This would help differentiate between the perceived difficulty of learners and teachers of materials relative to the learning goals that the materials were meant to foster. We note that there were relatively

higher ratings across most learners for the importance and amount learned, suggesting that only a small percentage may have faced frustration levels.

Responses to the video, workbook, and online materials as stand alone products

Video – The video design approach used fast-paced, documentary style footage, shot in actual workplaces, interviewing workers, supervisors, and human service personnel as the main vehicle for introducing, modeling, and maintaining the interest of the viewers. Each program also included staged vignettes using actors modeling problem solving on the job and bridging segments. A program host introduced basic concepts and provided bridging comments between segments. These latter two types of approach had a more deliberate pacing that the documentary footage.

Johnston and Young (1999) reported that responses to the video were mixed. While the fast-paced, *Finding a Job* programs were valued for their real world, documentary scenarios, the *Workplace Writing* videos were criticized for addressing too many issues in a superficial manner. Johnston and Young recommend that a smaller number of topics could be addressed in more depth, generally sound pedagogical advice for this audience. The mixed responses point out the difficulty of balancing a common, thematic visual approach across a video series (in this case, extensive documentary footage and quick jumps from topic to topic) by the domain of instruction. While the techniques described worked in the soft skills, real world domain of the "job search skills" programs, the same techniques were perceived as counter intuitive to the process of becoming a good writer, the content of the "writing skills" programs.

Workbooks – The workbooks followed a conventional workbook format, highly familiar to adult literacy teachers and learners and consistent with prior curriculum programs produced by KET to support their video series. The workbooks employed a high percentage of case scenarios sampling across work domains of service, industry, office, and health to help learners problem solve with authentic context problems.

Johnston and Young reported that teachers and learners found the workbooks familiar, easy to teach and follow, clear in task demands, but somewhat uninteresting and difficult to read. We have previously discussed at length the issue of reading difficulty. The role of the workbooks in relation to the integrated classroom environment is still unclear. Are they to be used to guide pre- and post-video group discussions or as individual tutorials? Are they best used for introducing content, practicing skills, or both? More field

study of different classroom (and non-classroom) instructional environments will be necessary to understand better the optimal conditions for mixing and integrating all the media.

Online Materials – The organization structure of the online instruction was a unit. A unit corresponded to each Video program/Workbook chapter, which consisted of two basic types of activities: video and Internet. A unit video activity began with a webpage that introduced a 45 sec. to 1 min. video clip from the corresponding video program. This was followed by another webpage of basic concepts, a webpage of activities based on the video clip with text boxes for saving responses to an online portfolio, and a follow-up page of reflection activities and suggestions for group or extended learning activities on the topic. The Internet activity followed the same basic structure, except that the first webpage introduced an external Internet site and the activities were based on tasks to do when visiting that website. We have already addressed the issues of redundancy in the website design, so they will not be repeated here.

Johnston and Young reported that teachers and learners found the online materials the most appealing and exciting, and appreciated the dual benefit of learning the curriculum content and new computer and technology skills at the same time. A main issue for the future was how much prerequisite skill would benefit the learners versus learning basic computer motor, typing, and navigation skills as part of the curriculum. A second issue to address in the future is the cost versus benefit of streaming video over the web, given the many technical problems of speed and transfer that video caused in this pilot.

Pedagogical assumptions underlying the writing and media design

The approach to workplace writing in the WES Communications and Writing workbook describes a "process for writing" then models and scaffolds this step-by-step process which includes the following: (a) identify your purpose, (b) gather facts and organize your thoughts, (c) select appropriate format, (d) write a first draft, (e) review and revise, (f) proofread, and (g) distribute writing. The tasks associated with these steps were practiced in simulated form by answering questions, editing simulated writing, and so forth. Other chapters focus on types of business writing including directions, forms, charts, memos, and letters. The online approach to these topics employed some of the same principles but offered a more developmental, free writing approach to the types of writing activities that learners were asked to engage in.

Johnston and Young (1999) noted a difference in pedagogical philosophy between the formulaic approach to writing as presented in the workbooks versus the more "process

writing" approach advocated in the online materials and activity. A second related issue also raised concerns about the limitations in the online technological support for process writing including limited writing space, a lack of peer review and teacher feedback, lost formatting, and no spelling or grammar checker.

Concerning the difference in philosophy approach, a recent article by the new test specialist for GEDTS, Arthur Holbrook (1999), is noteworthy. In observing the formulaic similarity of the GED essays that he reads, Holbrook suggests that formulaic writing techniques have an appropriate place in the development of basic skills of organization and structure, but that overemphasizing these techniques results in writers as slaves to form rather than communicators. He goes on to argue that the two most important elements in developing a piece of writing are audience and purpose and that establishing a voice requires frequent writing and empowerment about one's ability to communicate. Perhaps this is the pedagogical point that needs to be emphasized more concretely to teachers and learners. While the workbook provides some structured scaffolding as a foundation, the online approach has a goal of broadening the horizons at the next level of writing development.

Regarding the limitations in the technology tools, two points can be made. First, as designers we were unsure about the value and utility that teachers and learners might find in online portfolio tools. We also had very little time to create the technology for them. Consequently, we provided more teacher training materials describing how and when to use portfolios than we did power in the actual tools. The response reported by Johnston and Young suggests that it will be well worth our time to invest in enhancing those tools.

We have been investing that extra effort. We have already implemented teacher feedback mechanisms and are looking at online peer review tools. The issues regarding formatting and checking are technically more difficult for web tools, but we are experimenting with techniques for composing and working with word processors, then using the web portfolio for collecting, reflecting, and selecting. This strategy has the benefit of allowing learners to enhance their basic word processing skills at the same time asreaping the benefits of an asynchronous, omnipresent communications of the web. Nonetheless, we will probably have to wait for some new capabilities in the web technologies themselves before we can fully address users' desires for a writing environment that mirrors that found in word processing applications.

Effectiveness of the teacher's guide

The teacher's guide consisted of two major parts. The first provided an overview of the WES multimedia program and pedagogical approaches underlying the design, with

special emphasis on the organization, functions, features, and navigational aspects of the website. The second part consisted of *Before*, *During*, and *After* activity suggestions for each of the sub-objectives and sub-objectives in each of the media (i.e., video, workbook, and online materials). The resulting guide provided hundreds of activity suggestions.

Johnston and Young (1999) concluded that the teacher's guide assembled for the pilot attempted to do too much and too little. It did too much in providing *Before*, *During*, and *After* activities for each and every video, workbook, and online activity in the curriculum. By doing so, it often provided only shorthand lesson plan notes that did not fully prepare teachers for the demands of classroom implementation. On the other hand, the introductory sections on the pedagogical approaches, how to use the website, and how to integrate video, Internet, and workbooks were too short. In general, the entire formative report raises issues of teacher preparation, technical support, and the need for additional assessment and management tools. All of these are important parts of the next phase of product development.

Significance

We knew that integrating a multimedia learning system into the adult classroom would require some reorganization of the classroom as well as some level of teacher preparation and support. The formative evaluation helped us understand how much the media materials needed to be revised and how better to prepare teachers to transform their classrooms. In another component of the LiteracyLink system, LitTeacher, courses have been designed to enhance teachers' skills at integrating technology into the classroom or using video or Internet effectively as instructional tools. We acknowledge that we are creating products that challenge existing norms of teacher-led, workbook-driven instructional paradigms. We further admit that we are doing this in advance of wide-spread knowledge and skills in the field about how to implement the learner-centered, problem-focused, socially mediated techniques that underlay the design of the products. One benefit of this approach is that the materials we are creating can be used to demonstrate those techniques more easily than trying to adapt, for example, a traditional workbook activity. At the same time, we also anticipate and are supportive of teachers who apply a more gradual implementation strategy, perhaps integrating a single video or online activity into their existing curriculum, then slowly increasing the use of WES as a part of their curriculum. This approach was not directly tested in the formative evaluation. Regardless of implementation strategy, we recognize the necessity of providing extensive preparation and support for teachers and learners - we cannot assume that the materials themselves will reform or transform adult education.

Emerging web technologies and multimedia approaches are on the verge of permitting customized learning environments that are not merely automated, sequenced, "programmed instruction," but rather dynamic, interactive, and collaborative settings in which learners can search, process, and produce knowledge. Although many in the field of adult education have long articulated the need to recognize adults as partners in the setting of goals and customizing of instruction to personal experiences, needs, and desires (e.g., Merriam & Caffarella, 1991), designing classroom-based instruction that embodies these principles has been difficult to achieve with the limited resources of most programs.

WES and the LiteracyLink system will, for the first time, incorporate and test the effectiveness of many adult learning principles in a technology-based environment, and therefore serve as a valuable test-bed for future innovations in adult literacy instruction. However, the creation of customized materials raises many new issues of program and classroom structure and teacher training and preparation. A great deal of research needs to be done to understand the tradeoffs between flexibility and complexity of materials as they influence the design of products and the preparation for implementation in diverse settings.

References

Beck, I. L., & McKeown, M. G. (1989). Expository text for young readers: The issue of coherence. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 47-66). Hillsdale, NJ: Erlbaum.

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 453-494). Hillsdale, NJ: Erlbaum.

Flagg, B. N. (1990). *Formative evaluation for educational technologies.* Hillsdale, NJ: Erlbaum.

Freire, P. (1970). *Pedagogy of the oppressed.* New York: Seabury Press.

Giovengo, M., Moore, E. J., & Young, G. (1998). Screening and assessment results of the learning disabilities initiative: Identification of individuals with learning disabilities in the job opportunities and basic skills program. In S. A. Vogul & S. Reder (Eds.), *Learning disabilities, literacy, and adult education* (pp. 179-194). Baltimore, MD: Brooks Publishing.

Ginsburg, L. (1998). Integrating technology into adult learning. In C. E. Hopey (Ed.), *Technology, basic skills, and adult education: Getting ready and moving forward* (pp. 37-46). Columbus, OH: ERIC Clearinghouse on Adult, Career, & Vocational Education.

Holbrook, A. (1999, March/April). Formulaic writing: Blueprint for mediocrity. *GED Items,* p. 8-9.

Houle, C. O. (1984). *Patterns of learning: New perspectives on life-span education.* San Francisco: Jossey-Bass.

Johnston, J., & Young, S. J. (1999). *A pilot test of Workplace Essential Skills & LitTeacher professional development courses* (Evaluation Report). Institute for Social Research, University of Michigan.

Jonassen, D. H., & Reeves T. C. (1996). Learning with technology: Using computers as cognitive tools. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 693-719). New York: Simon & Schuster Macmillan.

Knowles, M. (1990). *The adult learner: A neglected species* (fourth edition). Houston: Gulf Publishing.

Merriam, S. B., & Caffarella, R. S. (1991). *Learning in adulthood.* San Francisco: Jossey-Bass.

Mezirow, J. (1995). Transformation theory of adult learning. In M. R. Welton (Ed.), *In defense of the lifeworld: Critical perspectives on adult learning* (pp. 39-70). Albany, NY: State University of New York Press.

Stites, R. (1998). Adult learning theory: An argument for technology. In C. E. Hopey (Ed.), *Technology, basic skills, and adult education: Getting ready and moving forward* (pp. 51-58). Columbus, OH: ERIC Clearinghouse on Adult, Career, & Vocational Education.

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